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ENGINEERING REPORT
FOR
COMPARISON OF COSTS
OF
ALTERNATE LINES
ON
INTERSTATE ROUTE 94

WIBAUX CO. LINE WEST

PREPARED BY
MONTANA STATE HIGHWAY COMMISSION
INTERSTATE DIVISION

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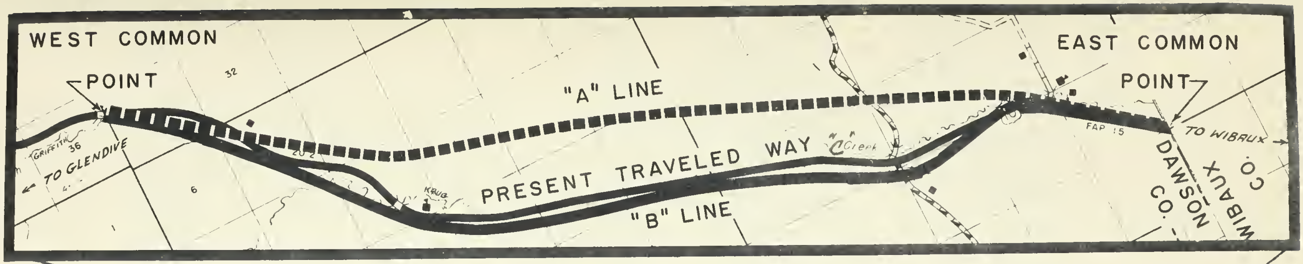
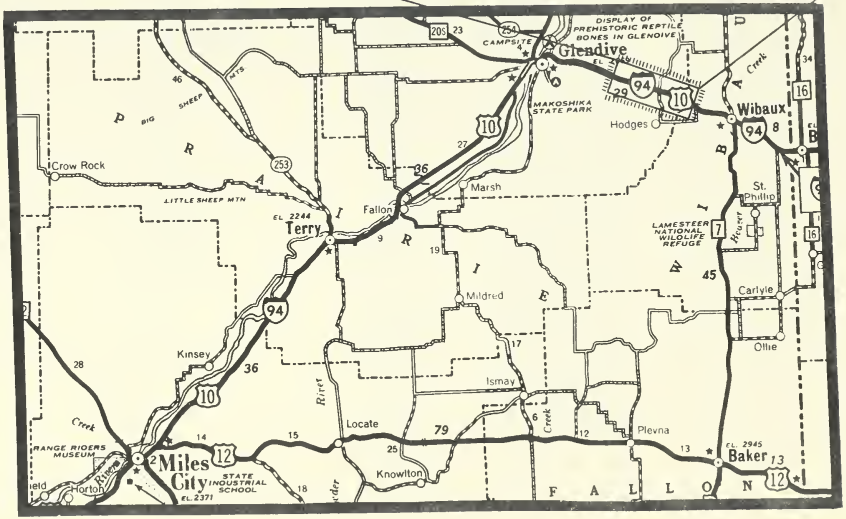


ALTERNATE LOCATIONS STUDIED



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ECONOMIC ANALYSIS OF ROUTINGS OF
INTERSTATE HIGHWAY NO. 94
BETWEEN
GRIFFITH CREEK AND THE DAWSON - WIBAUX COUNTY LINE

FOREWORD

An economic analysis of this type is prepared for the purpose of presenting factual data which may be used in determining the most favorable highway routing where more than one location is under consideration. Although the analysis deals with many features of highway location, its principal function is to evaluate those considerations that can be reduced to monetary terms. These considerations include the cost of constructing the alternate routes, the cost of maintaining each route and the cost that will be incurred by the highway-user in traveling on each route.

Since the cheapest route to construct and maintain does not always provide the best service to the highway-user, it is also necessary to consider vehicular operating costs in determining the route which is of greatest overall benefit. Since Federal and State funds for the support of highways are obtained almost entirely from highway-user taxes, the most favorable highway location from the standpoint of the highway-user would be the route that has the lowest overall cost when all construction, maintenance and vehicular operating costs are taken into consideration.

This report deals with determining the most favorable routing of Interstate Highway No. 94 from the Griffith Creek Bridge to the Dawson - Wibaux County Line. As previously mentioned, the principal factors in an analysis such as this are:

1. Construction Costs.
2. Maintenance Costs.
3. Highway-user Costs.

The alternate routes studied were:

1. A route that generally parallels present US 10.
2. A shorter, more-direct route north of present US 10.

The North Route will hereafter be referred to as the "A" Line and the Parallel Route as the "B" Line.

DESCRIPTION OF THE ROUTES

"A" Line

The "A" Line begins at the west common point of both lines at the Griffith Creek Bridge approximately six miles east of Glendive. From this point, the line bears to the southeast, crossing present US 10 at approximately "A" Line Station 713. It continues bearing southeast until it crosses an access road at "A" Line

Station 792. Then it traverses rolling terrain north of the present US 10 and intersects the Hodges County Road approximately 0.8 of a mile north of present US 10. The Interstate is bridged over the county road. Continuing southeasterly, the line traverses more rolling terrain and crosses Krug Creek at approximately "A" Line Station 1198. The line then continues to the east common point at the Dawson-Wibaux County Line.

"B" Line

The "B" Line begins at the west common point at Griffith Creek. From here it cuts across a curve in present US 10, changes direction and cuts across another curve in present US 10, thereby severing present US 10. This severence of present US 10 would be adjusted to keep the road in use for local service. From this point, the line drops off a bench into Krug Creek.

The crossing of Krug Creek entails channel changes and a bridge. After crossing Krug Creek, the line returns to a point just south of the present US 10 and generally parallels it to a point approximately one and one half miles west of the Hodges County Road. The line changes direction and passes behind a fairly large stock reservoir. The line crosses the Hodges County Road at approximately "B" Line Station 508. The Interstate is bridged over the Hodges County Road where it changes direction and bears almost due east for slightly less than a mile and a half. Here it changes direction and generally follows the present US 10 to the east common point at the Dawson-Wibaux County Line.

CONSTRUCTION COSTS

Both routes feature:

1. A new bridge at Griffith Creek.

2. Two-lane construction.

3. Separation structures at the Hodges County Road.

Total construction cost of the "A" Line is estimated at $2,361,000. The total construction cost of the "B" Line is estimated at $2,392,800.

The "A" Line earthwork was greater than the "B" Line earthwork but the "A" Line did not require a bridge at Krug Creek. The "A" Line's shorter length resulted in a reduction of 0.28 mile of construction. The detailed costs of the various construction items are listed near the end of the report.

The following table is a summary of the construction cost of each line developed as annual costs, using a 4% Capital Recovery Factor. Because of the variation of service lives of different items, it is necessary to reduce total costs to annual costs on the basis of the service life of each item.

TOTAL AND ANNUAL CONSTRUCTION COSTS

ITEM	LIFE	4% CRF	"A" LINE TOTAL	"A" LINE ANNUAL	"B" LINE TOTAL	"B" LINE ANNUAL
ight-of-Way	50	.0465	$ 49,000	$ 2,280	$ 58,000	$ 2,700
ructures	50	.0465	130,000	6,050	185,000	8,600
Grading	40	.0505	587,700	29,680	502,600	25,380
ainage Pipe & Stockpasses	40	.0505	136,900	6,910	161,900	8,180
Utility Adjustments	40	.0505	1,500	80	3,500	180
se & Surfacing	20	.0736	911,500	67,090	931,700	68,570
ncing	20	.0736	76,000	5,590	77,600	5,710
Guardrail	20	.0736	82,300	6,060	64,700	4,760
affic Control Devices	20	.0736	15,000	1,100	15,000	1,100
Rest Area	20	.0736	20,000	1,470	20,000	1,470
eding & Mulching	20	.0736	38,000	2,800	38,800	2,860
ontage Roads and just Cross Roads	30	.0578	15,000	870	33,000	1,910
Preliminary Engineering	40	.0505	96,700	4,880	97,600	4,930
onstruction Engineering & Engineering Contingencies	40	.0505	201,400	10,170	203,400	10,270
			$ 2,361,000	$ 145,030	$ 2,392,800	$ 146,620

It can be readily seen that construction costs are so nearly equal that they are not a significant factor in the comparison of the two lines.

MAINTENANCE COSTS

The Interstate maintenance costs are the only ones taken into consideration since present US 10 would be maintained for local service with the use of either routing.

ANNUAL MAINTENANCE COSTS

LINE	COST/MILE	MILES	ANNUAL COST
"A" LINE	$2,000	12.66	$25,320
"B" LINE	2,000	12.94	25,880

Since the annual maintenance costs differ by only $560 per year, maintenance costs are not a significant factor in the comparison of the two lines either.

HIGHWAY USER COSTS

The traffic on this section of highway is essentially through traffic. Less than four per cent of all traffic is of local origin or destination.

The length of the "A" Line is 0.28 miles shorter than the "B" Line. Because of this shorter distance, the highway-user costs are considerably less for the "A" Line. The highway-user benefits in favor of the "A" Line are shown in the following table.

20-YEAR HIGHWAY-USER COSTS

LINE	20-Year Average Annual Operating Cost	Average Annual Savings	20-Year Savings
"A" LINE	$ 1,769,230	$ 39,130	$ 782,600
"B" LINE	1,808,360	----	-----

As seen from the Table, the savings in highway-user costs over the next twenty years is estimated to be $782,600. This amounts to an annual average savings of approximately $39,130 per year. It is apparent that highway-user costs are the most significant factor involved in the comparison of the two lines.

ANNUAL ROAD-USER COSTS

Present (1962) ADT = 1750 Vehicles
Future (1982) ADT = 3975 Vehicles
Average (20-Year) ADT = 2862 Vehicles

15% Trucks - Assume 1 Truck = 3.5 Cars
AVERAGE ADT = 3935 Equivalent Cars

20-Year Average Operating Costs

"A" LINE
(3935) (365) (.0973)(12.66) = 1,769,230

"B" LINE
(3935) (365) (.0973)(12.94) = 1,808,360

Road-user costs were estimated on an annual basis using the adjusted average ADT for the next twenty years. Computations were based on the manual "Road User Benefit Analyses for Highway Improvements", published by the American Association of State Highway Officials, with operating costs adjusted to current local prices.

SUMMARY OF ANNUAL COSTS

The annual costs of construction, maintenance and vehicular operations are summarized in the following table:

SUMMARY OF ANNUAL COSTS

LINE	CONST. COST	MAINTENANCE	ROAD-USER	TOTAL
"A" LINE	$ 145,030	$ 25,320	$ 1,769,230	$1,939,580
"B" LINE	146,620	25,880	1,808,360	1,980,860

Average annual difference = 41,280
20-year difference = 825,600

CONCLUSION

This analysis shows:

1. No significant difference in construction costs of the two lines.
2. No significant difference in maintenance costs of the two lines.
3. A very substantial difference in vehicular operating costs favoring the "A" Line.
4. An estimated 20-year savings of $825,000 favoring the "A" Line.

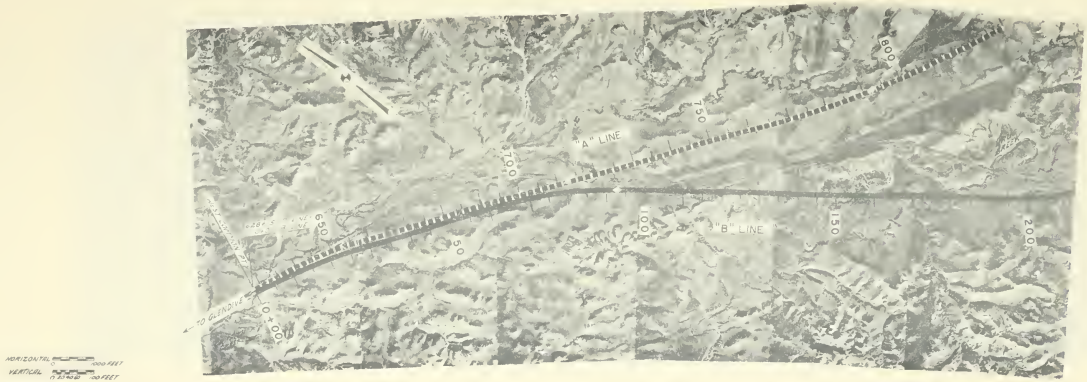
On the basis of the results of this analysis, it is to be concluded that the "A" Line routing would be the most favorable location for this section of the Interstate Highway System.

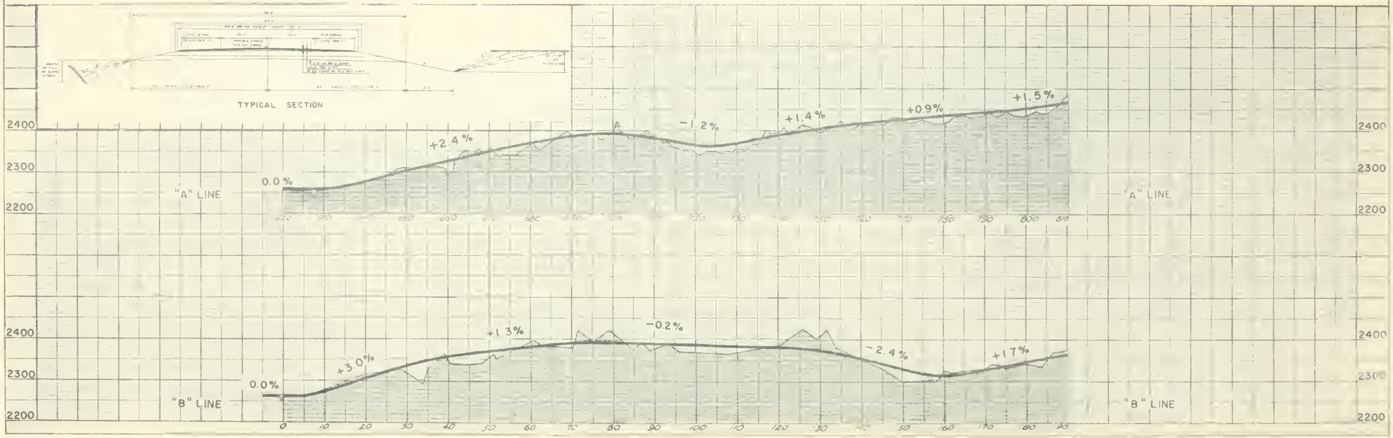
"A" LINE CONSTRUCTION COSTS

EM .	DESCRIPTION	UNIT	UNITS	AVERAGE COST PER UNIT	TOTAL
1	Right of Way	Lump Sum	---	---	$ 49,000
2	Structures	Lin. Ft.	260	500	130,000
3	Grading	Cu. Yd.	1,781,000	0.33	587,700
4	Drainage Pipe & Stockpasses	Lump Sum	---	---	136,900
5	Utility Adjustments	Lump Sum	---	---	1,500
6	Base and Surfacing	Mile	12.66	72,000	911,500
7	Fencing	Mile	12.66	6,000	76,000
8	Guardrail	Lin. Ft.	34,300	2.40	82,300
9	Traffic Control Devices	Lump Sum	---	---	15,000
0	Rest Area	Lump Sum	---	---	20,000
1	Seeding & Mulching	Mile	12.66	3,000	38,000
2	Adjust Cross Roads	Lump Sum	---	---	15,000
3	Subtotal, Items 2-12				2,013,900
4	Preliminary Engineering	4.8% Line 13			96,700
5	Const. Engineering & Contingencies	10% Line 13			201,400
6	Total				$ 2,361,000

"B" LINE CONSTRUCTION COSTS

TEM O.	DESCRIPTION	UNIT	UNITS	AVERAGE COST PER UNIT	TOTAL
1	Right-of-Way	Lump Sum	---	---	$ 58,000
2	Structures 44' Wide	Lin. Ft.	370	500	185,000
3	Grading	Cu. Yd.	1,523,000	0.33	502,600
4	Drainage Pipe & Stockpasses	Lump Sum	---	---	161,900
5	Utility Adjustments	Lump Sum	---	---	3,500
6	Base & Surface	Mile	12.94	72,000	931,700
7	Fencing	Mile	12.94	6,000	77,600
8	Guardrail	Lin. Ft.	26,950	2.40	64,700
9	Traffic Control Devices	Lump Sum	---	---	15,000
0	Rest Area	Lump Sum	---	---	20,000
1	Seeding & Mulching	Mile	12.94	3,000	38,800
2	Frontage Roads & Adjust Cross Roads	Lump Sum	---	---	33,000
3	Subtotal Items 2-12		---	---	2,033,800
4	Preliminary Engineering	4.8% Line 13	---	---	97,600
5	Const. Engineering and Engineering Contingencies	10% Line 13	---	---	203,400
6	Total				$ 2,392,800


800
750
"A" LINE
700
650
WEST COMMON PT.
TO GLENDIVE
0+00
50
100
"B" LINE
150
200
HORIZONTAL 0 1000 FEET
VERTICAL 0 20 40 60 100 FEET


TYPICAL SECTION
2400
2300
2200
"A" LINE
0.0%
+2.4%
-1.2%
+1.4%
+0.9%
+1.5%
620
630
650
660
680
720
730
750
760
780
790
800
810
"B" LINE
0.0%
+3.0%
+1.3%
-0.2%
-2.4%
+17%
0
10
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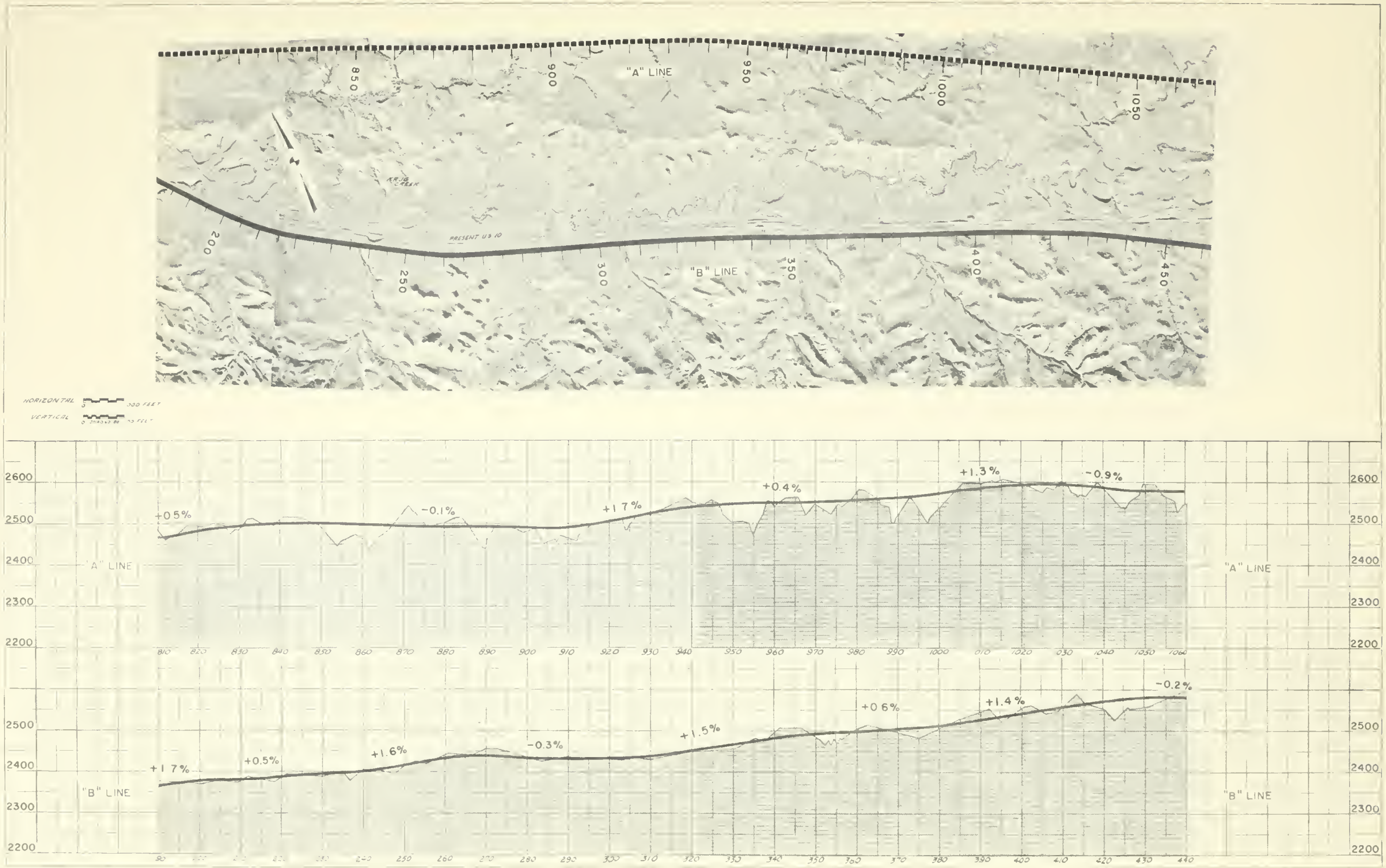
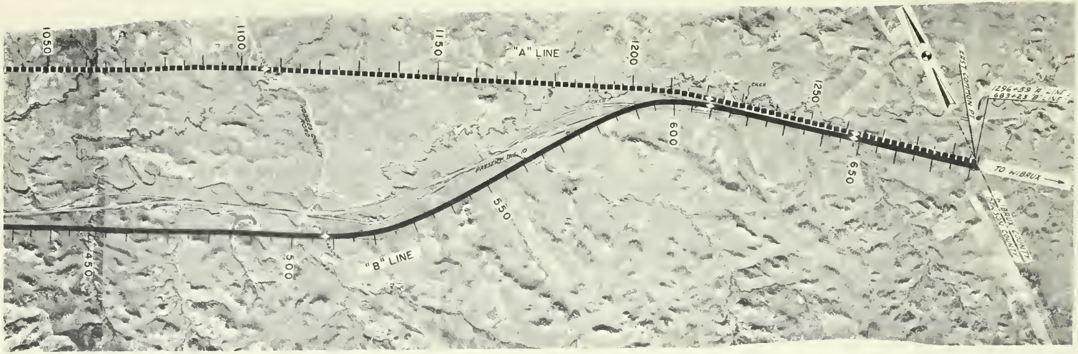
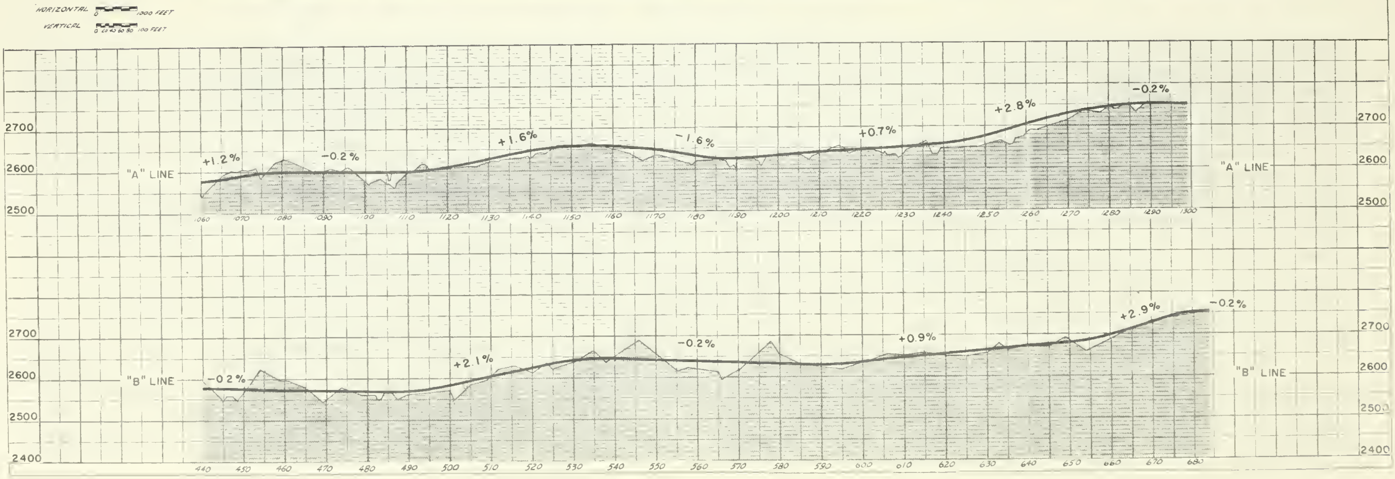
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190


"A" LINE
850
900
950
1000
1050
KRUG CREEK
PRESENT US 10
"B" LINE
200
250
300
350
400
450
HORIZONTAL 0 300 FEET
VERTICAL 0 20 40 60 80 FEET
2600
2500
2400
2300
2200
"A" LINE
+0.5%
-0.1%
+1.7%
+0.4%
+1.3%
-0.9%
810 820 830 840 850 860 870 880 890 900 910 920 930 940 950 960 970 980 990 1000 1010 1020 1030 1040 1050 1060
"B" LINE
+1.7%
+0.5%
+1.6%
-0.3%
+1.5%
+0.6%
+1.4%
-0.2%
190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 390 400 410 420 430 440


1050
1100
1150
"A" LINE
1200
1250
EAST COMMON PT
1296+59 "A" LINE
683+23 "B" LINE
TO WIBAUX
WIBAUX COUNTY
DAWSON COUNTY
650
600
550
PRESENT U.S. 10
HODGES COUNTY ROAD
"B" LINE
500
450


HORIZONTAL 0 1000 FEET
VERTICAL 0 20 40 60 80 100 FEET
"A" LINE
+1.2%
-0.2%
+1.6%
-1.6%
+0.7%
+2.8%
-0.2%
1060 1070 1080 1090 1100 1110 1120 1130 1140 1150 1160 1170 1180 1190 1200 1210 1220 1230 1240 1250 1260 1270 1280 1290 1300
"B" LINE
-0.2%
+2.1%
-0.2%
+0.9%
+2.9%
-0.2%
440 450 460 470 480 490 500 510 520 530 540 550 560 570 580 590 600 610 620 630 640 650 660 670 680
2700
2600
2500
2400